Although the particles of Caruso et al. are described as "template particles," they are not in any way analogous to the templates of the present invention. The template particles taught by Caruso et al. do not contain pores, and therefore the method does not include deposition into a pore, as recited in claim 1. As pointed out above, the method of Caruso et al. does not provide deposition <u>into</u> a template, but rather deposition <u>on the surface</u> of a template <u>particle</u>. Claims 1-7 are not, therefore, anticipated by Caruso et al.

Furthermore, the method of claim 1 and the method of Caruso et al. are used to manufacture completely different types of particles and therefore require completely different template structures and manufacturing methods. The coated particles and hollow shells of Caruso et al. are manufactured by building up concentric layers of material around a core particle and then, if desired, dissolving the core particle. The particles of the present invention are made by sequentially depositing materials that form the segments of the resulting particle. Because of these differences, the particles of Caruso et al. could not be formed by deposition into pores, as recited in claim 1. There would, therefore, be no motivation to add templates with pores to the method of Caruso et al., and Applicants submit claims 1-7 to be patentable over Caruso et al.

Claims 1-7 were also rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,997,958, issued to Sato et al. Applicants assume that the Examiner intended the rejection to be under 102(e), because Sato et al. issued on December 7, 1999, while the present application was filed on October 2, 2000 with a priority date of October 1, 1999.

Sato et al. discloses a method for depositing nanometer-scale particles onto a substrate (e.g., silicon) for formation of a quantum electronic device such as a single electron transducer. The particles aggregate on the surface to form wires or other features. In all cases, the particles are not produced independently of the substrate; rather, the particles are added to form part of the device made from the substrate. Particles remain on the surface of the substrate throughout and after device manufacture. Clearly, Sato et al. is not directed to nanoparticle manufacture by depositing materials that, in combination, form a nanoparticle, but rather to deposition of nanoparticles that, in combination, form an

additional device. This is in no way analogous to the method recited in claims 1-7.

As set forth below, Applicants believe that Sato et al. does not disclose a number of the elements recited in claim 1 and therefore cannot anticipate the present claims 1-7. Furthermore, because of the completely different purposes of the two methods, there would be no motivation to add such features to the method of Sato et al.

Claim 1 recites a method for manufacturing a "freestanding" segmented nanoparticle. Sato et al. does not teach freestanding nanoparticles; i.e., particles "that are produced by some form of deposition or growth within a template have been released from the template. . . [and] are typically freely dispensable in a liquid and <u>not permanently associated with a stationary phase</u>" (page 11, lines 5-8; emphasis added). The nanoparticles deposited in the method of Sato et al. remain associated with the substrate on which they are deposited: "The released gold particles thus move over the surface of the substrate seeking a location to be anchored. While the particles are moving on the surface, they are loosely held by the van der Waals force between the Au particles and the substrate." (col. 5, line 63 -- col. 6, line 1). The purpose of the method of Sato et al. is not to form freestanding particles, but is rather to form devices in which deposited nanoparticles are anchored to a substrate.

Sato et al. does not teach segmented nanoparticles. Sato et al. teaches deposition of pre-existing nano-scale particles onto a surface, followed by aggregation to form features smaller than 10 nm on the surface. Nowhere are segmented particles mentioned or suggested.

Sato et al. does not teach deposition of first and second materials into the pores of a template. Sato et al. teaches deposition of particles of a single type onto a substrate, which is not a template containing pores. A template is also referred to in the present application as a mold (page 11, lines 17-19). The substrate of Sato et al., in contrast, does not function as a pattern that guides the form of the piece being made. In most of the embodiments described in Sato et al., the substrate has a planar surface onto which the particles are

deposited. In one embodiment, shown in FIGS. 5a-5d, a monolayer of particles is deposited on the bottom surface of a trench. The purpose of the trench is to provide an edge at which the particles can aggregate, as shown in FIG. 5c. The particles do not take the shape of the trench, and thus the substrate does not serve as a template containing pores. Note that the "sites" referred to in Sato et al. are not pores, but rather areas of polar chemical moieties (e.g., protonated amino groups) on the substrate surface that attract oppositely charged particles (e.g., negatively charged Au particles). See col. 5, lines 7-8 and 16-23.

Regarding depositing first and second materials, Sato et al. teaches deposition of one type of particle, e.g., a gold particle. A liquid surfactant is added to the particle monolayer to disrupt the bonding between the particle and surface, but this liquid surfactant is not a second material that is deposited on the substrate.

Sato et al. does not teach releasing nanoparticles from a template. Rather, the term "releasing" is used in Sato et al in the sense that the nanoparticle is allowed to move over the surface of the substrate from its site of initial deposition to seek a location to be anchored (col. 5, lines 61-65). This word has a completely different meaning in the present invention, in which it refers to a particle's separation from the template in which it was deposited or grown to become "freestanding," as discussed above. In Sato et al., the released particles remain associated with the surface. The purpose of the method of Sato et al. is to deposit structures onto a substrate, not to form particles. In fact, contrary to the method of the present invention, the particles in Sato et al. begin as freestanding particles that are then affixed to the substrate.

Because Sato et al. clearly does not teach many of the elements in claim 1, applicants submit that claim 1 and its dependent claims 2-7 are not anticipated by Sato et al. Furthermore, because the method of Sato et al. has a different purpose from that of claims 1-7 and does not result in freestanding nanoparticles, there would be no motivation to add these features to the method of Sato et al. Applicants therefore submit claims 1-7 to be patentable over Sato et al.

Claim Rejections – 35 USC §103

Claims 8 and 9 were rejected under 35 U.S.C. 103(a) as being unpatentable over Caruso et al. and Sato et al. as applied to claims 1-7, and further in view of U.S. Patent No. 6,093,302, issued to Montgomery. The Examiner states that Caruso et al. and Sato et al. fail to expressly teach placement of first and second materials on the template by an electrochemical technique, but that Montgomery provides such a technique. In particular, the Examiner maintains that Montgomery teaches a "technique wherein free standing nanoparticles are formed by electrochemical deposition of first and second materials on a substrate template at col. 5, lines 23-50."

Claims 8 and 9 depend from claim 1, and are asserted to be patentable for at least the reasons Applicants have explained above. For example, Applicants maintain that neither Caruso et al. nor Sato et al. teaches the claim elements asserted by the Examiner. Montgomery does not teach these claim elements either. For example, Montgomery does not teach deposition into a template pore; in fact, none of the references teaches deposition into a template pore. Because the references do not teach or suggest all of the claim elements, a *prima facie* case of obviousness cannot be established.

Applicants respectfully disagree with the Examiner's summary of the teachings of Montgomery. Montgomery teaches a method for synthesizing polymers on a solid surface (or "substrate"). No nanoparticles are formed, freestanding or otherwise. Rather, Montgomery is directed to the synthesis of individual polymer molecules (e.g., DNA or polypeptides) at particular array locations by means of a "solid phase polymerization technique" which generally involves the electrochemical removal of a protecting group from a molecule on the substrate (col. 11, lines 15-28). Thus, there is no electrochemical deposition of first and second materials as described in the present application, only electrochemically-driven reactions between monomers and molecules on the surface. Montgomery does not disclose a template or mold to function as a pattern that guides the form of the piece being made. Thus none of the claim elements lacking in Caruso et al. and Sato et al. are provided by Montgomery.

Not only do the references not teach all of the claim elements, there is no motivation to combine the references, nor is there expectation of success in so doing. Caruso et al. teaches a method for making coated particles and hollow shells, while Montgomery teaches a method for making a surface array of polymer molecules. The Examiner states that Montgomery enables placement of material at specific locations on a substrate template, and that this would be beneficial in the method of Caruso et al. However, the particles of Caruso et al. require a uniform coating, not placement of materials at specific locations on the template particle. Furthermore, the methods could not be combined to make an array of coated particles or hollow shells, as asserted by the Examiner.

Sato et al. teaches a method for depositing nanometer-scale particles on a surface, not monomers. The monomers of Montgomery are in solution and bond to the growing polymer by an electrochemical reaction. The particles of Sato et al. are solid particles and are therefore added to the surface in a completely different manner. There would be neither motivation nor expectation of success in combining the two teachings.

For at least these additional reasons, applicants submit claims 8 and 9 to be patentable over Caruso et al., Sato et al., and Montgomery et al.

None of the other prior art of record—U.S. Patent No. 6,162,532, issued to Black et al.; U.S. Patent No. 6,143,211, issued to Mathiowitz et al.; and U.S. Patent No. 5,547,748, issued to Ruoff et al.—discloses a method for manufacturing nanoparticles by deposition into template pores, as recited in claims 1-7.

Thus, applicants request that the Examiner reconsider the application and issue a Notice of Allowance in the next Office Action. If it would be helpful to obtain favorable consideration of this case, the Examiner is encouraged to call and discuss this case with the undersigned.

This constitutes a request for any needed extension of time and an authorization to charge

all fees therefor to deposit account No. 19-5117, if not otherwise specifically requested. The undersigned hereby authorizes the charge of any fess created by the filing of this document or any deficiency of fees submitted herewith to be charged to deposit account No. 19-5117.

Respectfully submitted,

Date: September 27, 2002

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Marked-up version of the specification amendments:

Page 4, lines 12-28:

The present invention includes methods of manufacture of [free-standing] freestanding particles comprising a plurality of segments, wherein the particle length is from 10 nm to 50 µm and particle width is from 5 nm to 50 µm. The segments of the particles of the present invention may be comprised of any material. Included among the possible materials are a metal, any metal chalcogenide, a metal oxide, a metal sulfide, a metal selenide, a metal telluride, a metal alloy, a metal nitride, a metal phosphide, a metal antimonide, a semiconductor, a semi-metal, any organic compound or material, any inorganic compound or material, a particulate layer of material or a composite material. The segments of the particles of the present invention may be comprised of polymeric materials, crystalline or non-crystalline materials, amorphous materials or glasses. In certain preferred embodiments of the invention, the particles are "functionalized" (e.g., have their surface coated with IgG antibody). Commonly, such functionalization may be attached on selected or all segments, on the body or one or both tips of the particle. The functionalization may actually coat segments or the entire particle. Such functionalization may include organic compounds, such as an antibody, an antibody fragment, or an oligonucleotide, inorganic compounds, and combinations thereof. Such functionalization may also be a detectable tag or comprise a species that will bind a detectable tag.

Page 11, lines 4-14:

The present invention is directed to the manufacture of freestanding nanobar codes. By "freestanding" it is meant that nanobar codes that are produced by some form of deposition or growth within a template have been released from the template. Such nanobar codes are typically freely dispensable in a liquid and not permanently associated with a stationary phase. Nanobar codes that are not produced by some form of deposition or growth within a template (e.g., self-assembled nanobar codes) may be considered freestanding even though they have not been released from a template. The term ["free standing"] "freestanding" does not imply that such nanoparticles must be in solution (although they may be) or that the nanobar codes can not be bound to, incorporated in, or a part of a macro structure. Indeed, certain embodiments of the invention, the nanoparticles may be

dispersed in a solution, e.g., paint, or incorporated within a polymeric composition.

<u>Marked-up version of the claim amendments:</u>

1. (amended) A method for the manufacture of a [free standing] <u>freestanding</u> segmented nanoparticle by the deposition of a plurality of materials inside a template<u>,</u> comprising:
   a) causing deposition of a first material into [the pores] <u>a pore</u> of said template;
   b) causing deposition of a second material into [the pores] <u>said pore</u> of said template; and
   c) releasing said segmented [nanoparticles] <u>nanoparticle</u> from said template.

5. (amended) The method of claim 1 wherein <u>at least one of</u> said first <u>material and said</u> [or] second material is a metal.

8. (amended) The method of claim 1 wherein the deposition of <u>at least one of</u> said first <u>material and said</u> [or] second material is [done by] <u>an</u> electrochemical deposition.